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Identifying Countermeasure Strategies to Increase Safety of Older Pedestrians

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16. Abstract <p>The increase in the older population as well as its increased frailty has led the National Highway Traffic Safety Administration (NHTSA) to conduct research initiatives examining the safety and mobility of older adults. Although older adults are struck less frequently than children, they are more likely to die after being struck due to frailty or physical complications. With that in mind, NHTSA is interested in developing effective countermeasure strategies that can be strategically targeted towards the prevention and mitigation of crashes involving older pedestrians.</p> <p>The objective of this project was to identify appropriate countermeasures that will reduce older pedestrians' exposure to injuries and fatal crashes. This involved exploring countermeasures within the area of transportation as well as in other fields such as public health and education with the intention of identifying strategies that can be implemented to increase older pedestrian safety. Additionally, experts in the fields of aging, occupational therapy, transportation safety, traffic engineering, aging and ophthalmology, gerontology, and older pedestrian safety were contacted. These individuals provided contextual information to help explain the dynamics behind older adults' involvement in pedestrian crashes as well as insights into what strategies might be effective in communicating with older adults to effect change in their walking behavior.</p> <p>This background research was intended to identify strategies used in disseminating information to older populations as well as strategies used to effect change in the behavior of older adults. This report is a review of key literature from the public health, education, and transportation fields that may provide insights on how to develop future programs targeting older pedestrians.</p>			
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Identifying Countermeasure Strategies to Increase Safety of Older Pedestrians

1. Background

In the United States, pedestrian fatalities are 36 times higher than motor vehicle occupant fatalities per miles traveled (Pucher & Dijkstra, 2000). In 2010, 4,280 pedestrians were killed and an estimated 70,000 were injured in traffic crashes. Pedestrian deaths accounted for 13% of all traffic fatalities in 2010, and made up 3% of all the people injured in traffic crashes (NHTSA, 2012). While older adults (defined in this report as adults 65 and older) made up 13% of the U.S. population, older pedestrians accounted for 19% of all pedestrian fatalities and an estimated 11% of all pedestrians injured in 2010. Adults age 65 and older are a fast growing segment of the U.S. population. By 2030, the number of older adults is expected to almost double to 72.1 million (Administration on Aging, 2010), suggesting that if the current fatality rate remains constant, older pedestrians will make up an even larger portion of all pedestrian fatalities.

Although older adults are struck less frequently than children, they are more likely to die after being struck due to their frailty or physical complications (Cottrell & Dharminder, 2003). Typically, older pedestrian crashes involve crashes at intersections, with left-turning vehicles, and occur at long street crossings. Older adults are overrepresented in crashes during daylight hours, weekdays, and in the winter (Zegeer et al., 1993; Blomberg, 2005). They are less likely to be involved in crashes related to unsafe pedestrian behavior such as mid-block or improper crossing (Insurance Institute for Highway Safety, n.d.).

2. Objective

In order to promote safe walking among older adults, with the related benefits to health, environment, and quality of life, it is important to identify appropriate countermeasures that will reduce pedestrian risk of injury and increase walkability. The objective of the current study was to identify and provide input to the development of countermeasure strategies targeted towards the prevention and mitigation of crashes involving older pedestrians. In order to fully comprehend the dynamics behind older pedestrian crashes, one should first explore factors such as the cognitive and physical conditions experienced by older adults, design features of intersections and roadways, the weaknesses and strengths of various social marketing strategies, and any other issues that may influence pedestrian safety among older adults. Next, best practices and new ideas which may be pertinent for development of countermeasure strategies should be identified and adapted so that they can be effectively delivered to older pedestrians. To facilitate the development of such strategies, this study conducted informal interviews with experts in the fields of transportation and pedestrian safety, aging, geriatric medicine and assessment, occupational therapy, ophthalmology, and physical mobility. In addition, a thorough

literature review identifying countermeasures that have been used to educate or change the behavior of older adults in a wide variety of areas was completed. Countermeasures were identified from a variety of fields including health communications and traffic safety. This report describes the methodology used for this information gathering task and provides results concerning issues in pedestrian safety for the 65 and older population. It includes results for studies that looked at age ranges other than 65 and older, but whose findings help to inform the older pedestrian issues being discussed. This report also discusses the implications of the findings for developing strategic approaches to improve pedestrian safety among older adults.

3. Analysis of Information From Experts

Contact with experts in the field provided a means to obtain unpublished data, and identify sources that might fill current information gaps. A list of experts was prepared in collaboration with the NHTSA Task Order Manager (TOM). The experts were invited to be interviewed and appointments were scheduled. A total of thirteen experts from a variety of fields were interviewed. This sample was comprised of 8 experts who were external to the research team and its sponsor, and 5 experts who were internal to one of the research team's organizations (or its sponsoring organization). The interviewees' areas of expertise are summarized below:

- Pedestrian crash risk, including older pedestrian crash risk;
- Geriatric medicine and assessment;
- Aging and ophthalmology;
- Safe communities for diverse populations;
- Transportation safety;
- Bicyclist and pedestrian safety;
- Transportation planning and strategy;
- Occupational therapy;
- Pedestrians and pedestrian facilities;
- Older driver crashes and law enforcement; and
- Transportation services for persons with special needs.

A concerted effort was made to identify insights that the experts had regarding countermeasure strategies that could be developed, and have the experts fill in information gaps in the area of pedestrian safety. The focus of each interview was tailored to the professional's area of expertise and its relationship to older pedestrian safety. When respondents granted consent to have the interview audio-taped, full transcripts of the interview were made for subsequent analysis. In other cases, handwritten notes from the interview served as a record of the respondent's comments. Key concepts and ideas were extracted from the interview transcripts and notes, and coded in a data-scoring matrix for summary.

4. Analysis of the Literature

The objective of the literature review was to integrate information from the health, education, and transportation fields to summarize what is known about communicating a message to the older adult population to change their behavior. The inquiry identified components of countermeasure strategies and target audience considerations such as:

- Age of the target population;
- Other demographic characteristics of the target population (ethnicity, income level, education level);
- Physical limitations of the older adult population (vision, mobility); and
- Risk perception of older adults.

Westat conducted the literature search, which included examining results from experimental and quasi-experimental research, focus groups, and reports on various community outreach programs. Searches were conducted in Westat's in-house library catalog, and the Internet. The research team accessed a variety of information databases, including MEDLINE, library catalogs and other resources available on the Internet. Some of the expert contacts recommended additional literature references as well as media and educational materials.

Relevant materials were downloaded from the Internet or obtained via the Westat library. Each piece of literature was then reviewed. Over 130 articles and literature pieces were reviewed for this report.

5. Integration of the Data from Experts and Literature Review

Information provided by the experts was integrated with that from the literature review to establish a better understanding of various strategies adopted in disseminating health-related information to older adult populations. Westat synthesized information obtained from articles, organizations, experts, and other sources into a comparative review to provide insight as to how best to proceed in planning future programs targeting older pedestrians.

6. Age-Related Changes and Their Effect on Functional Abilities of Older Pedestrians

The act of walking and crossing the street may appear to be a purely physical activity; however, this activity engages complex visual and cognitive functions as well. Many of the experts interviewed identified a number of age-related changes that affect the functional ability of older adults to safely walk and cross the street. These changes include diminished physical capability, sensory perception and cognitive skills, and lag in reflexive responses. Falls are another central health issue among older adults; they are more likely to experience falls and are more likely to be injured in a fall than their younger counterparts (Centers for Disease Control and Prevention, n.d.). A fear of falling may influence how older adults choose to navigate streets. With age, the complexity of the road environment becomes more difficult; in particular, complicated intersections become more risky. Physical declines affecting older adult pedestrian safety include slower gait, lesser strength, and poor balance.

6.1 Physical Changes

Barriers to walking among older adults include health problems, access issues (such as narrow sidewalks, uneven walking surfaces, and excessive sidewalk cross slopes), and a lack of pedestrian facilities (such as refuge islands and signalized pedestrian crossings). Changes in physiological and sensory abilities of older adults make them particularly vulnerable to injury as pedestrians. The effects of aging on pedestrian safety are not likely due to any one or two changes, but to general declines experienced across functional dimensions. Interviewed experts hypothesized that in the area of age-related changes those that are important to consider when discussing older adult pedestrian safety include:

- Diminishing strength, agility, and endurance;
- Diminishing bone density, increasing fragility;
- Diminishing proprioception (i.e., the body's sense of its location within space, such as awareness of foot position) due to disease/ peripheral neuropathy;
- Decreasing range of motion; and
- Increasing risk of multiple medical conditions (diabetes, Parkinson's disease, dementia, Alzheimer's Disease, respiratory disorders, cardiovascular diseases, cerebrovascular diseases, etc.).

These changes can affect functional capabilities, and lead to:

- Slower walking speed;
 - Use of walking aids (e.g., canes, walkers) that may slow them further;
- Difficulty walking more quickly to meet situational demands; and
- Increased propensity to fall due to imbalance or unsteadiness on their feet.

Some of these physiological changes may affect the stability of older pedestrians when they walk, and their confidence when crossing streets, as well as their vulnerability to injury, severity of injury, and ability to recover after a crash. As we age, stiffness in joints and changes in the structure of bones may cause reduction in height, stooped posture, and limitations in mobility. Arthritis of the cervical spine can reduce neck movement, limiting one's ability to turn and check for oncoming vehicles. Physically, many older adults develop abnormal postural balance which can extend the amount of time needed to cross the street safely (Dillon et al., 2010). Slower walking speeds will lengthen the time it takes an older pedestrian to enter and cross the roadway, which in turn will increase their time in the intersection and exposure to moving vehicles. Slower moving pedestrians may be less detectable by drivers as movement is a cue that increases conspicuity. These physiological changes can, either singularly or in combination, impair older adults' ability to navigate quickly and safely across the street.

6.2 Visual Changes

Declining field of vision, visual acuity, contrast, and visual information processing may also inhibit safe road crossing (Oxley & Fildes, 1999). Some of the experts interviewed felt that visual and hearing deficits reduce the ability to detect threats (oncoming vehicles), as well as the ability to identify or interpret walk signs or traffic control device signals. Decreasing depth and motion perception may affect the ability to scan the road and make good pedestrian judgments regarding oncoming vehicles. Visual deficits can include: a slowing of visual processing speed, declines in ability to divide visual attention, reduced contrast sensitivity, and reduced peripheral vision.

6.3 Cognitive Changes

Cognitive declines in older adults result in increased time for decision-making and lengthen crossing time. Older adults typically experience declines in spatial awareness and attentional abilities, especially the ability to complete tasks involving divided attention. This may result in increased difficulty anticipating movements of vehicles as well as judging their speeds, which could result in uncertainty or reluctance to cross the street, delaying their start and slowing their progress when crossing. In turn, older pedestrians may adopt a variety of strategies in order to address their hesitations or uncertainty. They may choose to wait further back from the curb, move more slowly and cautiously as they cross the street, or take extra time to look down and around the road. All of these extend their time in the intersections and increase their exposure to traffic.

6.4 Self Awareness of Age-Related Changes

Older pedestrians may become aware of some but not all of the changes they experience as they age. In part, this may be due to the gradual nature of some of the changes. Older

pedestrians are likely to be more aware of physical changes such as slowing of physical movement. However, they are less likely to recognize changes in some aspects of visual processing and cognition because these changes are more gradual, and many of these processes occur outside of conscious awareness.

Physicians do not routinely test for changes in these processes, or establish baselines against which to measure declines. Therefore, experts suggest that this is one area where the application of educational countermeasures may be appropriate – namely, to inform and create awareness by older pedestrians of these changes, their effects, and how to cope with them. These areas include: the speed of visual processing (which slows with aging), declines in peripheral vision, and cognitive changes (such as ability to divide attention, to judge the speed of vehicles, etc.). Older pedestrians may not be aware of these “hidden” changes, and as one expert said, “as a messaging point, or point of education, these ‘hidden’ changes are those that may need to be communicated to older adults, along with an explanation of how these changes impact their safety as pedestrians.”

6.5 Complexity of Crossing a Street

All of the experts interviewed for this project acknowledged that crossing the street is a complex task. Pedestrians not only need to focus on the field of view directly in front of them, and on their destination, but complete a variety of subtasks, including:

- Select a place to cross the street that is consistent with their goals;
- Monitor objects and movement in their peripheral vision and identify threats;
- Be able to notice, attend to, and understand simultaneous information and stimuli, such as stop signs, signal lights, crossing signals, pedestrian right of ways, merge lanes, left turns, right turns (and right turns on red), etc. Older pedestrians need to integrate all of these sources of information in real time and make decisions about whether their intended crossing behavior is still appropriate or must change;
- Judge the speed of vehicles approaching the intersection or point of street-crossing;
- Judge the speed at which they, themselves, move (relative to the length of time a signal may give them to cross the street, or a gap in traffic may give them to cross);
- Make accurate judgment calls, such as where to cross safely, the time it will take them to cross, whether they are visible to vehicles that are approaching or turning or parking, etc;
- Notice changes in the situation at the point of crossing – and make decisions about whether to continue crossing or change their behavior; and
- Rapidly respond to changes in the situation.

While experts hypothesized that nearly all of these subtasks could be affected by functional declines associated with aging, they also indicated that it is largely unknown as to which ones are most important in contributing to the elevation of risk in the pre-crash period for older pedestrians. Age-related changes develop gradually and accumulate over time. In addition, there are huge individual differences in rates and magnitude of change. Together, these make the impact on functional abilities for crossing streets complicated to understand and address.

Several experts indicated that there is virtually no known research that has examined the strategies older pedestrians employ to compensate for the age-related changes they have experienced, or to understand what occurs pre-crash. There is little research on whether older pedestrians' errors or strategies may place them at risk in spite of their efforts to be safe.

Experts overwhelmingly agreed that current countermeasures used to increase older pedestrian safety are insufficient and need improvement. Most stated that more research should be devoted to determining which countermeasures are most effective in addressing pre-crash scenarios that result in older pedestrian injuries or fatalities. In addition, older pedestrian safety should be addressed holistically by integrating and applying a variety of countermeasure approaches. The countermeasures should address the physical, visual, and cognitive declines associated with aging rather than focus on one component.

The following sections of this report describe various strategies and countermeasures adopted by other health-related fields when attempting to change older adults' behavior or beliefs. Theoretically, these strategies may be tailored to develop countermeasures targeted towards the prevention and mitigation of crashes involving older pedestrians.

7. Health Communication Design

Health communication is more effective when it is relevant to the person's personal and social context (Neuhauser et al., 2009). In spite of their increasing numbers, there is inadequate knowledge about the personal and social context of older adults, which in turn affects how successfully information can be conveyed to that population (Pettigrew, 2004). In addition, older adults are underrepresented by the media when conveying a message (Lauzen & Dozier, 2005; Pettigrew, 2004). Commercial or entertainment channels often do not use relatable older adults when trying to communicate with this population. Often, younger actors or models with whom an older adult may not identify or relate to are employed as the messengers.

Noar (2006) summarizes the major principles of successful mass media health campaign design as follows:

- Conduct research using the target population to clearly understand the issue;
- Pretest messages prior to the campaign to verify that the messages are both appropriate and effective;
- Develop the campaign based on theory and theoretical models to help ensure that campaign messages guide individuals through the process of attitude and/or behavior change;
- Segment the target population into meaningful subgroups based on important characteristics such as demographic variables and risk characteristics;
- Design innovative and creative messages; messages should lead to interpersonal discussions; messages should persuade important stakeholders and influencers;
- Place messages at strategic times on popular media outlets. Choose times and outlets that will enable the message to be widely viewed by the target population;
- Conduct process evaluation including monitoring and collecting of data on exposure, reach and frequency of messages as well as implementation of campaign activities; and
- Conduct outcome evaluations using a design that allows for conclusions regarding the effectiveness of the campaign in changing attitudes and behaviors among the target population.

7.1 Participatory Models Used in Health Communication Campaign Design

Participatory or collaborative design with the target population is one method utilized to improve the outcomes of many media campaigns. Participatory design uses formative research methods to involve the intended consumer or audience as a co-developer of the program. This method is recommended in particular in designing programs or campaigns for population subgroups. Participatory design can include surveys, focus groups, expert panels, usability or readability testing, and interviews. Although participatory design is likely to be more expensive than traditional approaches, its proven effectiveness should yield larger benefits on the original investment (Neuhauser et al., 2009).

Participatory design methods were used to design a guidebook on choosing the appropriate health plan for Medicaid beneficiaries, older adults, and adults with disabilities (Neuhauser et al., 2009). An advisory group that included health care providers, policy makers, and Medicaid beneficiaries provided feedback on a prototype of the guidebook. The content of the guidebook included descriptions of the types of Medicaid programs, costs of plans, costs of prescriptions, and a list of doctors providing treatment under each plan. The guidebook was written in several languages. Interviews and focus groups were conducted with Medicaid recipients, older adults, and people with disabilities, to review the guidebook and

provide input related to literacy, language issues, and how to better adapt the guidebook for users with disabilities (hearing or sight impaired). Participants recommended that the guidebook include the following components:

- A clear explanation of all content, including terms;
- Clear comparison of the health plan choices in charts;
- Information about where to go for more information;
- Culturally adapted information for hearing-impaired consumers;
- Realistic explanations that are relevant for older adults; and
- Photos and stories of culturally diverse older adults and people with disabilities in health care situations.

Finally, a glossary was designed to provide explanatory information for Medicaid terminology. The guidebook was developed in 5 prototypes and there were 11 months of consumer testing. The final design was rated as highly suitable by both professionals and consumers.

Surveys and focus groups were used to identify best methods for designing educational strategies to promote organ donor registration among older adults (Downing & Jones, 2008). On the basis of this research, an educational brochure was designed to address knowledge and attitudes. The message, graphics, and font were designed based on the input from older adult participants. The brochure focused on the issues and questions that concern this age group and used photos of older adults to help convey the message.

7.2 Theoretical Models Used in Health Communication Campaign Design

There are a number of schools of thought on how to design effective health communication campaigns. A few of the theoretical models are especially appropriate for vulnerable populations such as older adults.

The Transtheoretical model (TTM) details stages of change along a continuum in a target population's readiness to change a behavior (Cancer Prevention Research Center, n.d). The five stages of change are: precontemplation, contemplation, preparation, action, and maintenance. Processes of change and the activities and experiences an individual engages in when attempting to modify problem behaviors affect the transition from one stage to the next. Taken into consideration are the positive and negative impacts of the change, confidence in the ability to change, and situational temptations to engage in the problem behavior. Additional variables that may affect progress are environmental, cultural, psychological, and socioeconomic characteristics.

The Theory of Planned Behavior (TPB) posits that behavior is determined by intention (a person's readiness to perform a certain behavior), which is in turn predicted by attitude toward the behavior (Ajzen, n.d.). The TPB model suggests potential interventions target: (1)

behavioral beliefs about the consequences of an action; (2) normative beliefs about how significant others such as family and friends perceive our behavior or social norms that dictate appropriate behavior; and (3) individuals' perceptions of their ability to perform the behavior. TBP has been applied to various health behaviors in such areas as nutrition, exercise, substance abuse, and road safety.

7.3 Implementing the Program or Campaign

Regardless of the model used in developing a communication campaign, successful campaigns apply effective principles to the following communication components: content, structure, exposure, and appeal. The following sections of this report provide examples of how this has been done to change the behavior of older adults or other populations.

7.3.1 Content

When developing a successful communication campaign, one of the most important components is the content or message. The content should clearly address the issues, questions, or concerns of the target population in a way that will change their attitudes or behavior.

A study conducted in Ohio used surveys and focus groups to identify information needs and barriers to organ donor registration among older adults (Downing & Jones, 2008). The results indicated that adults ages 50-70 differed from younger adults (ages 18 – 49) in their thoughts regarding organ donation. While older adults are often willing to donate organs, they also will often “opt out” due to concerns that their health or age serve as a barrier to organ donation. In spite of the advent of newer communication technologies, participants in the focus groups suggested a brochure as the best method to reach older adults and address their questions about organ donation. These questions included age and health criteria for organ donation, information on how the organs are selected without too much gory detail or medical jargon, and information on how the process would respect the body and religious practices.

An educational brochure on organ donation for older adults was then designed based on the input from the study participants. The brochure focused on the questions that concern this age group and used photos of older adults. The theme of the brochure was “Did you know you're not too old?” and the text followed a “did you know” format which provided answers to the specific questions voiced in the focus groups including: what is the maximum age for organ donation, does donation leave the body disfigured, is there a possibility that recipients may receive an unhealthy organ, and how do you sign up to become an organ donor? The brochure called on older adults in Ohio to become an organ donor and “Be a Hero.” The brochure was distributed via direct mail to people ages 50-70 who were renewing a driver's license or State identification card. The brochure was also provided to older adults at community-based health fairs across Ohio.

An in-depth literature review (Dunbar et al., 2004) pointed to specific pieces of advice that may be useful to convey to older pedestrians when discussing safety. These include:

- Information about functional declines that can occur with age and how this relates to pedestrian crashes;
- Advice on the importance of vision and hearing checks, and how to use appropriate vision and hearing aids in the road environment;
- Advice on when to seek additional support;
- Advice on the effects of alcohol, medication, and specific medical conditions;
- Advice on how to be more conspicuous (e.g.; reflective materials in low lighting conditions);
- Information on the importance of physical well being and the benefits of walking for good health; and
- Guidance for older adults regarding specific pedestrian activities and situations, such as:
 - Avoid complex road situations such as junctions;
 - Avoid high-speed roads;
 - Use refuge islands and crossings if available;
 - Be more aware of surroundings when navigating across two-way streets;
 - Be conservative when making gap judgments;
 - Cross at locations where traffic movements are easily anticipated;
 - Choose locations where there are long sight distances when crossing;
 - Conduct thorough visual search prior to crossing using entire upper body;
 - When crossing from between parked cars or across multiple lanes, walk to the edge of the vehicle and check for traffic again;
 - Be aware of situations in which vehicles may make unexpected movements, especially when crossing or walking near driveways or parked cars; and
 - Respect the right-of-way of vehicles in the roadway.

7.3.2 Structure

The development of a clear and concise message that is accurately presented in a timely manner is a basic criterion for sharing information with the public (OECD, 2000). Designing a simple message is crucial to the effectiveness of a given campaign or program.

Bombarding the target population with too much information will only dilute the message and confuse the issue, especially among older adults who may not be able to effectively process this information due to cognitive declines.

The success of a well-structured campaign is exemplified by the 1% or Less campaign, developed in 1994 by the Center for Science in the Public Interest. This community education campaign promoted a switch from high-fat to low-fat milk for adults and children as a way to decrease consumption of saturated fat; thereby decreasing a person's risk for developing heart disease. The campaign used a single message requiring a single dietary change (Reger et al. 1998). The campaign utilized combinations of paid advertising via newspaper, television, and radio, as well as community-based activities including press conferences, taste-tests, educational programs for children, and presentations by local health professionals at civic organization meetings and worksites in four West Virginia communities. The campaign was evaluated by tracking milk sales in local supermarkets and via pre and post- intervention telephone surveys. Low fat milk's market share increased from 18% to 41% of overall milk sales in the month following the end of the campaign. In the post-intervention telephone survey, 38.2% of respondents who reported drinking high-fat milk prior to the campaign's implementation indicated that they had switched to low-fat milk. Based on the results the researchers believed that a single focused message may be more effectively communicated through mass media than multiple or complicated messages.

An educational program using multiple messages was developed jointly by The National Resource Center for Safe Aging, the National Fire Protection Association (NFPA)- Center for High-Risk Outreach, and the Centers for Disease Control and Prevention. Sixteen key messages were developed by a technical advisory group of safety and aging experts. Remembering When: A Fire and Fall Prevention Program is an interactive, nostalgia-themed program that educates older adults on how to lower their risk of injury from fires and falls (NFPA, n.d.). Messages are reinforced with large print display cards, handouts, and games. The presentation features excerpts from humorous films familiar to older adults such as Laurel and Hardy. The materials are versatile and can be utilized by different stakeholders in various settings including home visits, group presentations, or as part of a larger campaign. Results of the program indicated that to effectively reach older adults, the program should be formatted to allow trained educators to personally interact with the older adults at locations where they live and socialize. The NFPA has recommended that community-based fire and life safety presentations for older adults incorporate the following attributes (Smerz, 2003):

- Allow plenty of time as older participants may become anxious if they are rushed;
- Anticipate an interactive and talkative audience; make sure to include a question and answer period;
- In a lecture, use appropriate lighting, reduce glare, and increase contrast;
- Keep a low pitched voice, speak slowly and clearly; and
- Design simple handouts.

In a study examining the opinions of older adults on occupant safety issues, focus group participants were asked for suggestions on how to communicate the importance of using seat belts to older adults (Levi & De Leonardis, 2008). Many of the participants stated that national campaigns are targeted at younger adults and therefore they ignore the campaign message. In order to get the attention of older adults, they said a campaign needs to focus on their generation. They also suggested a more grassroots approach.

7.3.3 Exposure

There are different methods to measure exposure to campaigns and messages. In media programming, including television, radio and the internet, exposure is evaluated using measurements of message reach and frequency. Reach is the proportion of the target audience, or number of target audience members, exposed to the message. Frequency is the number of times that the target audience is exposed to the message. Meta-analyses of health mass media campaigns have shown small-to-moderate effects on health knowledge, beliefs, and attitudes as well as behavior (Noar, 2006).

An example of the effectiveness of the mass media approach is the *Wheeling Walks* campaign, conducted in Wheeling, West Virginia, in 2001-2002. This multifaceted 8-week campaign, based on the constructs of the Theory of Planned Behavior and the Transtheoretical model, used paid advertising, public relations, and public health education activities to promote 30 minutes or more of moderate-intensity walking almost every day among sedentary 50- to 65-year-old adults (Reger et al., 2002). The campaign focused on the health benefits of walking. The media campaign purchased paid advertising to target households. The message was intensely and strategically targeted to reach the intended audience through media, including 683 prime time television ads, 1,164 broadcasts on local cable television stations, 1,988 ads on 12 local radio stations, 14 one-quarter page ads in 2 community newspapers, weekly media events, and community education activities. In a follow-up survey, over 90% of the respondents in the intervention community indicated that they had heard about the Wheeling Walks campaign. The most frequent reported media mode was television (76% reporting they had seen the ads and 81% had seen television news stories). Only 32% reported hearing the radio ads, and less than 5% reported seeing or participating in any of the public health education programs (church, worksite, speaker's bureau activities).

It is important to note that while exposure to the message is important to the success of any campaign, the campaign content and structure should be targeted towards communicating with older adults. National campaigns directed at the general population tend to be ignored by older adults (e.g.; *Click It or Ticket* or *Buckle up America*). Many older adults assume these programs are directed towards their younger counterparts (Levi & De Leonardis, 2008).

7.3.4 Types of Appeal

Based on a variety of studies it is clear that appeals to older adults should provide information and guidance on the effects and consequences of their behavior to themselves and to those around them (Downing & Jones, 2008; Levi & De Leonardis, 2008; Tait et al., 2006). If presented in a clear and appealing manner it is possible to effect a change in behavior. For example, as noted earlier, a study to identify best methods for designing an educational strategy to promote organ donor registration among older adults found that older adults support the idea of organ donation. However, their belief that their health or age makes them ineligible is a major barrier to registration. These perceptions were often related to a lack of knowledge regarding the organ donation process. Based on these results, the type of appeal developed was one that provided adequate information about organ donation including information on the potential barriers to organ donation (Downing & Jones, 2008).

Older adults indicated in a series of focus groups that real-life images and stories of people are most effective in promoting a change in behavior (Levi & De Leonardis, 2008). Images and stories from real-life individuals are often seen as more credible, and credibility has been found to be an important basis for the design of media messages to induce safety and health behavior.

In a study examining pedestrian risk taking behavior, hypothetical risky road crossing scenarios were presented to subjects by way of a questionnaire (Evans & Norman, 1998). Results of the survey indicated that those respondents who thought it would be easy to cross the road were more likely to indicate their intent to cross the road in spite of the risk. Thus, when a potentially hazardous road crossing behavior is seen to be easy to perform, the person is more likely to engage in the behavior. In a scenario that included the presence of other pedestrians, social pressure reduced risk taking behavior. The study results suggested that attempts should be made to make pedestrians more aware of the difficulty and risks associated with crossing a road. Awareness and acknowledgement of the challenges and consequences may reduce risky pedestrian behavior among older adults.

In New South Wales, Australia, a multi-media campaign, *Stay Active Stay Independent*, was implemented to reduce falls among older adults by promoting physical activity. The multi-media campaign specifically targeted the 65-70 age group, although the program was designed to reduce falls by adults age 50 and above. The campaign used television, newspaper, posters and bus advertising (John-Leader, et al., 2008). It focused on four central strategies: establishing partnerships with local stakeholders, developing evidence-based messages, optimizing distribution of messages, and evaluation. In order to develop appropriate and effective messages, a series of focus groups was held. Creative industry students were enlisted to develop concepts that were then presented to the participants. Participants emphasized that campaign messages that include humor, reminisces, and appropriate images were the most effective. Images selected as most appropriate were of older adults engaged in affordable and feasible physical activities including walking,

gardening, swimming and tai chi. The campaign was conducted over 18 months and included 3 phases:

- Thinking – brief presentation of the importance of physical activity;
- Doing – promoting specific actions; and
- Being – maintenance and support of an active lifestyle.

Each phase of the campaign included both mass media as well as community outreach. Results of intercept surveys conducted during the second phase of the campaign indicated that more than one-third of the target population (age 50 and above) was exposed to the campaign, most commonly via television (58%). Of those exposed, 22% reported that they had become more active as a result of the campaign and an additional 33% reported an intention to increase activity.

7.3.5 Channels of Communication

There are a number of communications channels that may be used to promote health and safety among older adults, including: print media, television and radio, internet, community-based activities, training, and promotions via health professionals and caregivers. These channels are not mutually exclusive, and often multi-mode campaigns are launched.

The *Wheeling Walks* campaign was designed to promote walking among sedentary 50- to 65-year-old adults in Wheeling, West Virginia (Reger et al., 2002). Pre-intervention research indicated that sedentary adults believed that they had less control over their time and scheduling compared to those who regularly exercised. The campaign was designed to deliver a targeted public health message promoting 30 minutes or more of moderate walking almost every day. The ads suggested that older adults begin by walking as little as 10 minutes a day and work their way up to 30 minutes, the length of “one TV program.” The ads ended with a tagline “Isn’t it time you started walking?” Paid advertising included newspaper, radio and TV spots on channels favored by the targeted audience. The campaign also included weekly press conferences and campaign events. Local physicians were asked to prescribe to their patients that they walk 30 minutes or more almost every day, and seven local health professionals were trained to give presentations about walking and physical activity emphasizing its importance to good health and feeling more energetic. In addition, six ministers included the *Wheeling Walks* message in church bulletins or at worship services. The campaign earned extensive media coverage with more than 170 television, radio, and newspaper spots in the intervention community; and achieved 90% penetration in campaign awareness by the target population. The campaign also featured a long-term ecological and community partnership approach with a 37-member local advisory committee providing guidance and support. Based on observational and self-report surveys in the intervention community there was a 23% increase in the number of walkers and 32%

of the baseline sedentary population reported achieving the recommended moderate-intensity physical activity by walking at least 30 minutes at least five times per week.

The Miami-Dade Pedestrian Safety Demonstration Project utilized education, enforcement, and engineering countermeasures to increase pedestrian safety in intervention zones (Zegeer et al., 2008). Educational measures targeting adults included pedestrian safety posters in English, Spanish and Creole that were mounted on all county buses and most MetroRail train cars. A focus group was conducted with Haitian older adults to identify difficulties crossing streets in Little Haiti. Based on the results, two workshops were conducted with 100 participants to provide tips and information on pedestrian safety including avoidance of dangerous intersections and backing vehicles, and being conspicuous. The workshops included an intersection simulation exercise to practice intersection crossing skills. Additional safety workshops were conducted with older pedestrians throughout the project by the Miami-Dade pedestrian-bicycle coordinator. PSAs were broadcast in English and Spanish on city and county access channels and radio stations. A booklet was prepared for older adults on pedestrian safety *Walking Through the Years: Pedestrian Safety for the Older Adult (65+)* (DOT HS 809 083). The brochure presented risks and tips for older pedestrians. The brochure was distributed by various organizations in the county.

The demonstration project also included a study of the effects of enforcement of driver yielding behavior at crosswalks in Miami Beach. Officers flagged and issued citations to drivers not yielding to pedestrians. Officers from the Miami-Dade police received training on pedestrian safety and driver behavior that may endanger pedestrians. A number of engineering treatments were conducted throughout the demonstration community, some based on recommendations for pedestrian safety improvements by the research team. These included the addition of raised medians on multilane roads (refuge islands), addition of sidewalks, pedestrian warning signs, and revision of traffic signal timing in school zones. An analysis of crashes in the county showed that at the peak of the program countywide pedestrian crash rates were reduced by 8.5% to 13.3% (Zegeer et al., 2008). There was, however, no significant change detected in pedestrian crash rates for adults age 65 and older in spite of the educational countermeasures targeting this specific age group.

Snyder et al. (2004) conducted a meta-analysis of the effect of health communication campaigns on behavior change. Overall, campaigns have small but tangible effects on behavior change. That is, approximately 8% of the target population would adopt or increase the behavior targeted by the campaign. However, campaigns with enforcement messages were found to have greater success rates, where up to 17% of the targeted population will adopt or increase the behavior targeted by the campaign. Media campaigns have been shown to be less effective than interventions in clinical settings; however, they may be more cost effective as they reach a larger number of people. Finally, campaigns to promote new behavior may be more successful than cessation of an old behavior or prevention of an undesirable behavior.

7.3.6 Printed Media

A number of studies have found that printed media is a central source for learning and health information among older adults. Older adults (age 50 and above) responding to an AARP Survey on Lifelong Learning indicated that the tools they use most frequently for learning are print media such as books, newspapers, and journals (AARP, 2000). Participants in focus group studies have pointed to the AARP magazine as well as other printed brochures and newsletters as a good venue for communicating with the older adult population (Downing & Jones 2008; Levi & De Leonardis, 2008; Sarmiento, Langlois, & Mitchko, 2008).

As stated previously, older adults participating in the study to promote organ donation indicated that their preferred channel for health communication is brochures (Downing & Jones, 2008). They said that brochures provided more information than mass media messages. Older adults also stated that they are used to reading brochures about health and medical issues. Based on the input provided, brochures were designed to “answer questions,” provide information without the use of medical jargon or unnecessary detail, and depict how the organ donation process will respect the body and religious practices. An educational brochure was developed using messages, visuals, graphical styles, and larger font size based on information provided by the target age group. The brochure used photos of adults ages 50 to 70, focused on issues and questions important to this age group, and provided accurate information enabling readers to make informed decisions about organ donation.

Neuhauser et al. (2009) identified several methods to improve the effectiveness of printed media communication, including:

- Adaptation to suit the needs of specific subgroups in the population;
- Use of language and text that communicates a clear message;
- Incorporation of culturally relevant concepts and graphics;
- Adapted text rather than literal translation when converting to other languages; and
- Writing at a reading level that will be understood by the majority of older adults.

Regarding the physical design of printed material, it is vital to take into account the effects of aging on text comprehension including reduced quality of eyesight affecting focus and lighting needed for reading, as well as changes in cognitive capacity that cause increased difficulty in absorbing and evaluating unfamiliar information. Pettigrew (2004) reported that the following measures may maximize comprehension of text among older adults:

- Use slightly larger text;
- Refrain from using all upper-case text which may cause difficulties in readability;

- Use color to maximize contrasts, refrain from colors that are difficult for older eyes to discern such as blue-green combinations;
- Print on matte rather than glossy paper to reduce glare;
- Use short sentences and paragraphs to improve readability;
- Present only a few main points and communicate them in simple and explicit messages;
- Use concrete terms whenever possible;
- Refrain from extraneous information to reduce cognitive processing burden;
- Repeat the main message to assist in retention;
- Relate messages to existing knowledge to assist in integration of new information;
- Use pictures to reinforce presented messages; and
- Pretest messages and materials to ensure that they are appropriate for an older audience.

In the OECD publication, *Improving Transportation for People with Mobility Handicaps: A Guide to Good Practice* (2000), the European Conference of Ministers of Transport (ECMT) recommended using four basic criteria when designing information that will be shared with the public. Information should be clear, concise, accurate, and timely. For clarity of text, the guide recommended using: readable typeface (e.g., Helvetica, Airport, Futura, or Folio); lower case text with appropriate capitals; large print (minimum 14 pt, and preferably 19 pt for a brochure, and larger for distance from afar); and contrast in colors between the print and the background.

In a review of printed publications for adults age 50 and older on HIV/AIDS, recommendations were made on how to improve the visual presentation (Orel, Spence & Steele, 2005). Specifically, the authors recommended use of bold 20-point serif font with strategic underlining, highlighting, and borders to emphasize important messages as well as enhance readability. Publications may also be designed in an age-appropriate manner by using images of older adults, as well as excluding slang and acronyms as much as possible. In addition, the reviewers identified appropriate distribution points for brochures including sites that serve older adults: senior centers, retirement centers, meal sites, and health care facilities. Additional venues often accessed by older adults are pharmacies, banks, libraries, grocery stores, restaurants and entertainment or recreational facilities.

7.3.7 Visual Media

In Auckland, New Zealand, a pedestrian safety campaign to decrease pedestrian crossing against the crossing signal utilized a variety of visual media outlets (Harre & Wrapson,

2004). The 7-week campaign included painted footpaths and banners, as well as onsite activities including rewards and a mime performance to reduce illegal crossings. Slogans included “It is illegal to cross here—Use the crossing” painted on the roadway where pedestrians were observed crossing outside of the crosswalk. Billboards reporting statistics on casualties in motor vehicle crashes were posted near the designated intersections. Drivers were exposed to the banners but did not receive any of the interactive activity such as the mime or rewards. The results of the evaluation indicated that the campaign succeeded in decreasing crossing against the signal and increasing awareness of the legal requirement to cross at the crosswalk; however, there was not a change in general attitudes towards pedestrian safety or in driver behavior.

7.3.8 Television and Radio

Adult focus group participants 65 and older have pointed to television and radio, in particular local news shows, as potentially effective sources of information (Levi & De Leonardis, 2008). In a study on the utilization of news media and preferences among adults 55 and older, television was reported as the most widely used medium (86%), followed by newspapers (61%), and the radio (40%) (Chafetz et al., 1998). Respondents indicated that they were very interested in news stories about older adults (66%); however, few thought that the media showed an interest in news stories involving their age group (13%).

A series of focus groups with adults 50 and older from diverse racial groups examined awareness of cognitive health issues and methods to inform peers about healthy behaviors (Friedman et al., 2009). Television was the leading communication source mentioned, and was considered an appropriate medium to reach a broader audience. However, the participants did indicate that too much TV is unhealthy and addictive. Radio was also recommended as an important outlet to communicate health messages.

The *Stay Active Stay Independent* campaign in New South Wales, Australia delivered a multi-media campaign on fall prevention (John-Leader et al., 2008). Researchers conducted an intercept survey of the target population during the campaign. The most common media outlet identified as a source of information regarding the campaign was television, followed by the newspaper. More than one-third of respondents in the coverage areas were aware of the campaign. Of those, 21% reported seeking more information about physical activity and 22% indicated that they had become more physically active.

7.3.9 Internet

In a 2008 online survey, adults ages 50-65 were the heaviest users of Internet-based health information. Baby boomers (generally defined as born between 1946 and 1965) are proactive about health maintenance and information searches (McMillan & Macias, 2008). However, online access is not universal among older Americans. Age is one factor related to Internet access. While use is very high among the young older age group (ages 50 to 64),

the numbers drop with the oldest age group (age 80 and older). In addition, women are more likely to search for health information online than men, as are higher educated older adults compared to those with fewer years of formal education. Census data on Internet access among adults 65 and older indicates that there has been an increase from 15% in 2000 to 42% in 2011 (U.S. Census Bureau, 2012).

Face-to-face or computer media has been found to be more effective than print-based mass communication. This may be due to the fact that face-to-face and computer delivery allow the information to be designed in a way that is relevant to the person's personal and social context (Neuhauser et al., 2009). In addition, being able to access information from home provides an added benefit for older adults.

In a study on Internet-based health communication with older adults, focus groups with participants age 60 and above were used to develop a model for online health interactions among this age group (Macias & McMillan, 2008). The results of the focus groups indicated that older adults are using the Internet to better understand their health situation, as a type of home visit. Less advanced users sometimes find the Internet confusing and the quantity of information overwhelming. The respondents had an aversion to spam and pop-up advertising. Government websites or Non-governmental Organizational (NGO) websites were described as being of higher quality than commercial sites, although sometimes less accessible. Time was considered an important factor; the time it takes to locate the information and assimilate the knowledge.

In a panel survey with adults age 55 and older on Internet use for health information, respondents were asked to report on their computer and internet use (McMillan & Macias, 2008). Most respondents had several years of experience using the computer and internet. Different types of Internet users were identified. Each of these groups had different attitudes and behavior patterns. Power users are computer savvy, and use the Internet for a variety of purposes. Power users often use the Internet to conduct research and look up health information on their own on multiple websites. They often seek information for others, and health communication campaigns for this group should be "extensive and savvy." In contrast, a distinct group of older men was identified with more traditional views on the role of the physician and more limited use of the Internet for health information. These health traditionalists give the physician greater control in the doctor-patient relationship. Physician-based information may be more appropriate for this group than online resources. Older adults who are more educated and healthier than their counterparts tend to avoid commercial websites and primarily use the Internet for interpersonal communication. The survey results indicate that even among older adults with Internet experience, different communication strategies will be necessary.

While countermeasures employing the Internet might be effective in communicating to some of the older adult population, it is important to note that many older adults do not use this media outlet as a source of information. In a program to promote exercise and healthy eating among older adults (ages 55-70) in Canada, Healthy U, an Internet site, was launched (Berry et al., 2009). Following the campaign, results of a telephone survey

showed that 15% of the respondents were aware of the website but only 4% had visited it. In a series of focus groups specific barriers were identified that influence access to the Internet. The participants indicated that not all older adults own computers, and that in particular, rural residents are less likely to have Internet access. Based on the feedback, printed material was found to be more useful for disseminating health information to that subgroup within the older population.

7.3.10 Community-Based Strategies

Older adults often look to community-based institutions and activities to gather information on health and safety. A leading strategy to promote health in the community is via alliances that unify diverse organizations for joint health or safety programs.

Walkable Neighborhoods for Seniors in Sacramento, California, was implemented to promote safe and accessible walking routes for adults age 50 and above in the community (Hooker, Cirill & Geraghty, 2009). The program was established by the local department of health, a nonprofit organization, and a local task force. Its goals were to increase public awareness regarding the benefits of physical activity as well as increase walking activity in the community. The campaign included assessments of safety and walkability by older residents, community workshops, walking groups, and advocacy for infrastructure improvements. Neighborhoods were selected based on features such as high percentage of residents over the age of 50, walkability problems, and high pedestrian crash rates. Older adults conducted walkability assessment surveys of the streets in the selected neighborhoods, and recorded issues with sidewalks, curbs, crosswalks, traffic signals, trees, lights, and driver behavior. Access to bus stops, train stations, parks and shopping areas was also assessed. Presentations at local senior centers and flyers were used to recruit older adults for the walking groups that allowed for older adults to travel in a safe and social environment. The walking groups also served as local pedestrian safety advocacy groups that were instrumental in promoting improvements for the local walking environment. Finally a sustainable long-term plan for the task force and for future funding was developed. A process evaluation was conducted to track the success of the program. Progress reports and interviews with participants and staff pointed to success in improving the walking infrastructure and increasing walking among older adults in the intervention neighborhoods. Among the central components in the program, an effective local leader was considered essential.

The *Walk Wise, Drive Smart* program in Hendersonville, North Carolina, was designed to improve pedestrian safety and walkability for older adults (Hunter & Hunter, 2008). Hendersonville is a community with a relatively high percentage of residents age 65 and older (over 30%). However, the infrastructure in the town was not conducive to pedestrian activity. *Walk Wise, Drive Smart* became part of the Henderson County Livable and Senior Friendly Community Initiative, an active local network. The program was initiated in select neighborhoods with a high percentage of older adults. Meetings were held with older

residents to discuss challenges to safe pedestrian activity. Residents completed a local environmental walking survey followed by an additional detailed scan including photographs by program staff. *Walk Wise, Drive Smart* included a number of community-based components:

- Education for professionals and community residents about safety and walkability, including a Safe Routes for Seniors course, distribution of a Safe Walking and Driving flyer, yellow “Slow Down Neighbors Walking” yard signs, prize drawings for courteous drivers, and neighborhood walking maps;
- Enforcement efforts in targeted locations to discourage unsafe behaviors by motorists that endanger pedestrians;
- Sidewalk and crosswalk improvements; and
- Increased walking activity among older adults in the community.

The *Live Long, Live Well* walking program was established by the New Jersey Department of Health and Senior Services' wellness initiative¹. The primary goal of the program is health and fitness for residents age 50 and older. *Live Long, Live Well* participants receive a free walker's logbook with helpful hints to make walking a safe, fun and beneficial experience. Participants can walk alone, with a friend, or with a group. Each walker gradually works up to walking 30 minutes, or the equivalent of 2 miles per day, 4 or 5 days a week. Participants track their progress in the logbook and those who walk regularly for 12 consecutive weeks receive a *Live Long, Live Well* Walking Program Certificate of Achievement. The program resulted in an increase of physical activity as reported by 88% of the participants. Eighty-five percent reported walking with a partner or in a group. There are over 35 walking clubs in 13 counties in the State. Since the program's inception in 2002 over 350,000 miles have been logged by older adults.

The *Safe Routes for Seniors* program in New York City was designed to improve the pedestrian environment as a means of encouraging older adults to walk more and prevent older pedestrian injuries (Transportation Alternatives, 2009). The program was established in a number of neighborhoods by coordinating with local older residents. The program included older adults using maps, measuring wheels, stop watches and disposable cameras to document dangerous walking conditions. Older adults were given an opportunity to design solutions in a series of design workshops. The most common issues they identified as a hindrance to walking were:

- Uneven pavement or pavement obstacles;
- Inability to complete street crossing during walk cycle; and
- Vehicles not yielding to pedestrians in the crosswalk.

¹ <http://www.mayorswellnesscampaign.org/toolbox/seniors-in-motion/seniors-in-motion-live-long-live-well-statewide/>

The results of the workshops and documentation were provided to city agencies to promote policy changes. The program generated a series of walking clubs for older adults, walking maps, pedestrian safety improvements in lower income neighborhoods, and adoption of the program by the New York State Department of Transportation. A pedestrian safety design portfolio was developed that included different types of low-cost and easy improvements to enhance walkability for older pedestrians.

Due to recognition that social and cultural norms as well as community policy and environment affect individual health-related behavior, the role of community health coalitions has grown (Meister & Guernsey de Zapien, 2005). The Centers for Disease Control and Prevention (CDC) has emphasized the importance of community health coalitions as agents of change with the ability to affect policy and the environment, and initiate programs that promote health-related behaviors, particularly in minority communities. An evaluation of Special Action Groups (SAGs) in Arizona targeting diabetes prevention, nutrition and physical activity found that the programs were successful in promoting a number of changes in the community. The SAGs, made up of traditional health promotion stakeholders as well as new partners, utilized public education and advocacy to promote a change in local policy and behavior including installation of walking paths and parks to encourage walking.

Peer groups and older adult social networks are another potential source to communicate health messages. *Learn, Share, and Live* is a cancer education program utilizing woman-to-woman promotion of mammography screening and knowledge sharing. This program was developed within the *System to Assure Elder Services* (STAES), an existing social network in St. Louis, Missouri, targeting urban minority women age 65 and older (Skinner, Arfken & Waterman, 2000). The program consisted of 3 initial core education sessions led by healthcare professionals that focused on breast cancer and screening, as well as how to promote screening among peers. These sessions were followed by peer-to-peer interventions to further disseminate the information. Options for peer-to-peer interventions included inviting a mammography van to your site, additional education sessions, and personal testimonials from breast cancer survivors. In a series of pre and post telephone interviews respondents reported on the effects of the peer-to-peer intervention including increased knowledge, as well as self-report of increased mammography screening.

Community-based programs often include group presentations, discussions, and other activities. However, older adults are generally not interested in traveling to receive a message unless transportation is provided (Smerz, 2003). In a survey of older adults in Milwaukee on Fire and Safety Education, the respondents indicated that the preferred method for education is a lecture, followed by use of video, television or newspaper. The preferred location was their own home or the communal room if they live in a facility.

7.3.11 Education and Training

It is also possible to promote health behavior via education and training. An AARP survey in 2000 indicated that the best way adults age 50 and older learn is through hands-on

experience and engaging the senses (AARP, 2000). Educational programs should be designed for older adults in context with their experience and knowledge. Presentations should be interactive as older adults have a lot of experience which they want to share.

The University of North Carolina Highway Safety Research Center developed the *Pedestrian Safety Workshop: A Focus on Older Adults* for NHTSA in order to provide communities with a set curriculum and training program to improve walkability in the community (2010).² The PowerPoint presentation contains seven modules on topics such as the benefits of walking, dangerous traffic situations, infrastructure and the walking environment, and how to create a safer environment and encourage walking. The workshop was designed with an instructor manual that details how to prepare for the workshop, including specific teaching instructions and notes for the PowerPoint presentation. While older adults are the primary target audience, other potential participants include traffic engineers, local government officials, law enforcement, public health professionals, walking advocates and others.

The training curriculum includes instructions on selecting a sample walking path for workshop participants to walk together. The sample walk is an opportunity to observe and record physical conditions in the local community. Participants are expected to provide feedback during the walk regarding different issues such as driver behavior, difficulty crossing streets, and pavement conditions.

The workshop also uses a handout with tips on Defensive Walking. Similar to the recommendations made by Dunbar et al. (see Section 7.3.1) the handout details those steps that older pedestrians can take to protect themselves. The tips are listed by topic: crossing, backing vehicles, being seen, and checking the environment. Participants in the workshop are provided with a detailed bibliography for further reading.

An educational campaign designed to increase burn prevention knowledge among older adults (age 60 and above) utilized a community presentation, burn prevention video, and interactive discussion to educate participants on different types of burn injuries, common risk factors, and preventative behaviors (Tan et al., 2004). The presentation and video were translated and presented in six different languages and participants received take-home materials including an educational brochure, magnet with a reminder to turn off the stove, and a liquid thermometer card to record water temperature from the hot water tap. A survey conducted 4-6 weeks later indicated that there was a significant increase in burn prevention knowledge. Respondents reported that the community presentation and discussion was preferred over the video, written materials, and other take-home materials.

The *InCHARGE* eye health education program was designed to promote comprehensive eye care among older African-Americans (Owsley et al., 2008). The program was presented

² In 2010 funding was provided by NHTSA via the University of North Carolina Highway Safety Research Center to a limited number of agencies for trial runs of the workshop.

to older adults in senior centers in Alabama. The presentation, by a health educator, included a series of messages, interactive questions and comments. Attendees received a booklet, contact information for eye care, and transportation services. In a follow up interview, survey participants indicated that *InCHARGE* did convey strategies for reducing transportation barriers, and more of the attendees reported having an eye exam since attending the program.

In a series of focus groups with older pedestrians (age 55 and above) in Hawaii, participants suggested better education programs in their State for both drivers and pedestrians. In addition, they suggested that the educational program include the distribution of reflective items to improve visibility of pedestrians during non-daylight hours (SMS, 2004).

Safe Routes to Schools focuses on child pedestrians navigating safely to and from school, combining education and outreach with infrastructure improvements. Components of the program might be adapted for older adults. In Marin County, California, the *Safe Routes to School* program succeeded in promoting walking, biking, and carpooling by students at the participating schools, primarily with the help of volunteers (Staunton, Hubsmith & Kallins, 2003). Community members documented the routes to schools. Geographical mapping was utilized to facilitate the creation of walking groups and safe routes to school. Solutions to improve safety were designed and implemented with the help of a local traffic engineer. Funds were obtained via grants from a private foundation as well as Federal, State and local government. Children were encouraged to walk or bike via educational programs at the schools. Results of self-report school-based surveys indicate that over a 3-year period, there was a 64% increase in the number of children walking, a 114% increase in the number of students biking, a 91% increase in the number of students carpooling, and a 39% decrease in the number of children arriving by private vehicle.

Tyrrell et al. (2004) tested whether educational interventions can modify pedestrians' beliefs about their nighttime conspicuity. Using a series of lectures and graphic videos and photos with different groups of students, the researchers found that the educational interventions reduced overestimates of conspicuity.

McComas, MacKay and Pivik (2002) developed a virtual reality program to train children on pedestrian safety techniques. A desktop virtual reality program, *CrossPoints*, was developed with the input of experts, including police, school resource officers, traffic investigators, local safety council members, public health department personnel, emergency department staff, physical therapists, occupational therapists, crossing guards, parents, and teachers. The virtual city consists of eight different types of intersections, each designed to teach children different aspects of pedestrian safety. At all the intersections, the child is required to: (1) stop at the curb, (2) look left-right-left, (3) walk on the sidewalk versus the street, and (4) stay attentive while crossing the street. Children were tested at school using a three-monitor display of a walk from a virtual home to a virtual school. A feedback component was incorporated into the software that prompts the children to stay on the sidewalk and stop at the curb until they complete looking left-right-left. If the participant is too close to a moving vehicle, a warning flashes on the screen and the child is sent back to the curb to retry

crossing. The training was conducted at both an urban and suburban school. Prior to and following the training, observations of child pedestrian behavior were conducted at intersections near the schools. The results indicated that in the suburban environment, but not in the urban area, children practiced increased safe pedestrian behavior following the training.

Dommes and Cavallo (2009) conducted a study of the effects of simulator training on older adult pedestrian behavior. The study employed an experimental group of adults, age 65 and above, enrolled in simulator-based street crossing training and a comparison group of older adults assigned to internet training. The street crossing simulation was based on the INRETS Sim2 driving simulator and addressed the needs and difficulties of older pedestrians. The training program promoted individual sensory-motor practice (via repeated practice on a simulator) and addressed older adults' ways of thinking about the task and the strategies they bring into play (via discussions, explicit feedback and instructions). Assessments were conducted before, immediately after, and again 6 months after the training using a simulated street crossing task. During the assessment, participants were instructed to cross the road when they judged it was safe to do so at a regular pace. When compared to Internet training, simulator training enhanced safe crossing behavior of the older pedestrians. Participants in the simulator training group made fewer unsafe crossing decisions than those in the internet group. When making the decision to cross, the simulator group selected a greater time gap in which to cross. In addition, participants in the simulator group crossed with larger safety margins (more time available after crossing to the opposite sidewalk prior to the next vehicle reaching the crossing line). However, the percentage of unsafe decisions increased with increasing vehicle speed for both the simulator and Internet group.

In a separate study, the effects of the simulation training were also compared to a group of younger participants (Dommes et al., in press). The hypothesis was that the simulator training would not have an effect on pedestrian behavior among the younger participants, but would result in improvement in older adults' behavior. In comparison to the younger participants, older pedestrians were able to improve their behavior to the point where there was no difference in the safety-related indicators between the two groups. The exception was the ability to judge the speed of oncoming vehicles and use this information when making road crossing decisions. Contrary to younger participants, older participants made more unsafe decisions when vehicles were approaching at high speeds. The findings in both studies related to unsafe decisions for vehicles traveling at higher speeds may reflect age-related sensory and cognitive deficits that are not enhanced by the simulator training.

7.3.12 Agents of Change

Due to the physiological declines associated with aging, many older adults make frequent and regular visits to physicians, occupational therapists, and physical therapists. These

interactions provide physicians and therapists with the opportunity to educate older adults on health and safety.

In many of the studies cited in this document, health professionals played a major role in communication programs:

- Local physicians promoted walking among sedentary adults in the Wheeling Walks campaign by writing “walking prescriptions” and giving lectures (Reger et al., 2002);
- Within the framework of the 1% or Less campaign, local health professionals were trained to give short presentations about nutrition that emphasized the importance of drinking low-fat milk (Reger et al., 1998);
- The Learn, Share, and Live cancer education program included sessions led by health care professionals to promote understanding about breast cancer and screening (Skinner, Arfken & Waterman, 2000); and
- Lassman (2001) detailed the role of emergency department nurses in promoting pedestrian safety education in the community for both children and older adults. As community educators, nurses are in the position to participate in pedestrian safety advocacy and education. In many cases nurses spend more time with patients than the medical doctor, providing them with ample opportunity to address these safety issues. Some of the lessons Lassman encourages communicating to older adults are the use of high visibility clothing and lights, walking facing the flow of traffic, walking without headphones, checking for vehicles even at intersections, avoiding crossing between parked vehicles, walking as rapidly as possible across the street, and checking for right- or left-turning vehicles.

Grandchildren are also among those who can influence older adults’ behavior. In a study on smoking cessation among older adults (age 68 and older), those participants who indicated an interest in quitting related that a central reason was the need to serve as a role model (Tait et al., 2006). Similarly, in focus groups with older adults, the participants voiced a higher likelihood of seat belt use when driving with grandchildren (Levi & De Leonardis, 2008).

7.3.13 Addressing Different Racial and Ethnic Groups

Differences in language or culture within the older adult population may demand specialized health communication design. In order to appropriately address different racial or ethnic groups, adaptation of programs or messages should go beyond translation alone.

Preferences for health information sources are diverse and are connected to a variety of factors. A number of studies have examined intervention media that are most likely to appeal to various racial groups and have found diverse preferences. Findings indicate a preference for print media among Asian Americans, verbal communication and testimonials

among American Indians, and multiple media sources as well as use of physicians and social networks among African-Americans (Friedman et al., 2009).

Using participatory design process, a Medicaid guidebook for older adults and persons with disabilities underwent linguistic adaptation to Spanish and Chinese. The content and format preferences were translated and presented in a way that was respectful of their respective cultures. Testing of the guidebook was carried out in the native language of the users. Recommendations were made by participants to include culturally adapted information as well as photos and stories of culturally diverse older adults and people with disabilities (e.g., the deaf) (Neuhauser et al., 2009).

In focus groups with Hispanic older adults, Latino-based television and radio were recommended as media modes (Levi & De Leonardis, 2008). Chinese and Vietnamese adults age 50 and older participating in focus groups on communicating brain health information also recommended using native language media outlets (Friedman et al., 2009).

8. Engineering Countermeasures

One of the primary approaches to preventing pedestrian injury is to modify the physical environment. Traffic engineering countermeasures can be highly effective in reducing risk and severity of pedestrian injuries. Engineering countermeasures may be applied when planning new roads or when making modifications to the existing environment. These adjustments can take place at intersections and along the roadway. Many of the countermeasures are applicable to all groups, while other measures are more specifically tailored for older adults or pedestrians with disabilities.

Urban design may increase walking among older adults. Features that promote walking include higher residential density, mixed land use, and location of destinations within walking distance from where older adults live (see Heath et al., 2006; Hodgson et al., 2004; Dumbaugh, 2008). In an AARP survey, older adults indicated that proximity to important destinations such as doctors' offices, places of worship, shopping centers, grocery stores and drug stores is an important community characteristic (Matthew Greenwald & Associates, 2003).

In recent years, many cities and counties have pursued programs to increase walkability, or quality of walking in the community. Steps that have been taken to make communities pedestrian friendly include using traffic calming techniques, improving intersections (e.g., curb extensions or center medians), adding or improving sidewalks, designing clearly labeled pedestrian routes, and adding amenities and aesthetics (e.g., benches, greenery, brick walkways) (De Cerreno & Nguyen-Novotny, 2006). It is important to note that many of the measures that increase walkability are related to safety as well.

8.1 Walking Speeds

Slower walking speeds are a major barrier for older adults' safety at road crossings. Older adults have a tendency to initiate crossing sooner than younger adults to compensate for their increased crossing time. In addition, age-related limitations may prevent older adults from correctly processing information about the approaching vehicle's speed. In a study examining crossing decisions by three groups of adults (ages 20-30, 60-70, and 70-80), a walk-across-road task was utilized to study crossing strategies and adaptive behavior. Using a driving simulator adapted for a pedestrian behavior study, the participants were instructed to cross the road in 24 different experimental situations covering a combination of 8 time gaps and 3 vehicle speeds. Older adults were observed accepting shorter and shorter time gaps for crossing as the speed of oncoming vehicles increased which put them at greater risk of a crash in high speed situations (Lobjois & Cavallo, 2009). They also tended to miss many safe opportunities to cross in front of vehicles approaching at low speeds.

In a series of focus groups on transportation issues conducted with older adults in three States, the top priorities identified to increase pedestrian safety were visible sidewalks, safer intersections, and more time to cross at the walk cycle. Inadequate signal timings were mentioned as a major source of difficulty for respondents (Kerschner & Aizenberg, 2004).

The average pedestrian walks at a rate of approximately 4 feet per second (or a quarter of a mile in 5.5 minutes). However, older adults often walk at much slower speeds. Older adults using a cane have a walking speed of approximately 2.6 ft/sec. Arthritis limits speeds to 2.2-3.6 ft/sec, while older adults using walkers walk at only 2.1 ft/sec (Oxley, Fildes & Dewar, 2004). Pedestrian intervals, the period in the intersection cycle that is allotted to pedestrian crossing, are normally timed according to the average pedestrian walking speed and are often inadequate for the needs of older pedestrians.

In a study conducted with older adults age 72 and older in New Haven, Connecticut, approximately 11% of the respondents reported difficulty crossing the street. These respondents were more likely to need help with Activities of Daily Living (ADLs), to have impaired vision, and to register a low mental status score (Langlois et al., 1997). Based on measurements of walking speeds with the study participants using an 8-ft course, fewer than 1% had a walking speed that allowed them to cross the street in the time allotted at signalized intersections (Langlois et al., 1997). Similarly, Coffin and Morrall (1995) conducted a field study that measured the walking speed of older pedestrians at different locations, including midblock crosswalks and crosswalks at different types of intersections. The findings pointed to a range of abilities and walking speeds. At intersections with traffic signals and high concentrations of older pedestrians, installation of technologies that allow for extended crossing time at a walking speed of 1.0 m/ second was recommended.

Currently, a recommendation to lower vehicle crossing speeds at intersections has been issued by the U.S. Access Board based on the requirements of the Americans with Disabilities Act, in particular for those intersections which are routinely used by individuals having slower walking speeds (Dumbaugh, 2008).

In an assessment of traffic management priorities in Australia, the following five priorities were identified to increase the safety of older pedestrians (Oxley & Fildes, 1999):

- Reduction of traffic speeds;
- Provision of a safe traffic environment;
- Reduction of traffic in high density areas;
- Adequate pedestrian intervals at signalized intersections; and
- Better public transport access.

8.2 Classification of Engineering Countermeasures

It may be useful to classify engineering countermeasures according to their intended outcomes. Retting, Ferguson and McCartt (2003) reviewed effective engineering countermeasures designed to reduce pedestrian injury and categorized them as follows:

- **Separation of pedestrians and vehicles by time.** This includes installation of traffic signals at intersections, exclusive traffic signal phasing for the pedestrian crossing signal, adequate yellow and all red signals for vehicles to allow for clear intersections during the pedestrian crossing phase, automatic pedestrian detection in lieu of pedestrian push buttons, traffic designs and pavement markings that encourage pedestrians to look for conflicts, and flashing lights installed in the pavement at crosswalks that are designed to prompt drivers to yield to pedestrians.
- **Separation of pedestrians and vehicles by space.** This includes sidewalks, refuge islands located in the medians of 2-way streets, curb extensions, and repositioning stop lines further away from the crosswalk in order to increase the distance between the pedestrian and the vehicle.
- **Engineering measures designed to increase visibility and conspicuity of pedestrians.** This includes increased intensity of roadway lighting as well as lights at pedestrian crossings at night, parking restrictions or roadway design to reduce parking near crosswalks, and bus stop relocation to reduce pedestrians entering the roadway in front of a stopped bus,
- **Measures to reduce vehicle speeds.** This includes roundabouts,³ lane narrowing, adjustments in roadway curvature, pedestrian refuge islands, and speed humps.

The Federal Highway Administration has sponsored the Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE) website (www.walkinginfo.org). PEDSAFE

³ Roundabouts are circular intersections that replace conventional intersections. Roundabouts require entering traffic to yield the right-of-way to vehicles in the circle. Roundabout design causes vehicles to enter at low speed.

is designed to provide practitioners with real world solutions to pedestrian safety issues, using interactive matrices and a computerized selection tool. The interactive matrices identify specific countermeasures that are applicable to each of 12 crash types or 8 performance objectives. The selection tool provides possible engineering, education, and enforcement treatments based on input for a specific location, goals of the treatment and information about crash issues at the site. PEDSAFE includes information and examples of 49 engineering, education, and enforcement countermeasures selected from among the following groups:

- Pedestrian Facility Design;
- Roadway Design;
- Intersection Design;
- Traffic Calming;
- Traffic Management;
- Signals and Signs; and
- Other Measures

In an extensive literature review, a six category classification for pedestrian safety infrastructure measures was developed (Gitelman et al., in press). The following engineering solutions were recommended in the literature and in consultation with local traffic engineering and road safety experts in Israel:

No.	Category	Infrastructure Solutions
1	Appropriate pedestrian facilities on street sections	Building of sidewalks
2	Mid-block crosswalk treatments	Grade-separated pedestrian crossing; adding a refuge island; removing visibility obstacles; road narrowing
3	Traffic calming measures for collector roads	Adding a raised median between the travel directions
4	Intersection design	Conversion of an intersection to a roundabout; raised separation to eliminate left turns; lane narrowing or elimination of a lane of vehicular traffic
5	Traffic calming measures for streets	Pedestrian zone; speed humps; raised crosswalks; pinch-point; Woonerf

6	Traffic signals	Exclusive green for pedestrians at junctions; pedestrians' green separated from vehicles' green at conflict locations
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Additional infrastructure solutions recommended for further evaluation include [Gitelman et al., in press]:

- Raised crosswalks on high-volume collector roads;
- Advanced lighting and roving eye display (eyes come up above the crosswalk display to cue the pedestrian to look before stepping off the curb). These may also appear at mid-block crossings and are operated by pedestrians to warn motorists to watch out;
- Zigzag markings on both sides of the crosswalk to prevent parking and lane changes near crosswalks;
- Advanced stop line near mid-block crossing on a dual-carriageway road;
- Pedestrian mid-block crosswalk signals including standard pedestrian push-button signals and signals based on pedestrian detection; and
- Adding flashing red lights to pedestrian signals, pedestrian countdown signals, pedestrian detectors for extending the clearance time or pedestrian detectors instead of pushing buttons at signalized crosswalks.

8.2.1 Traffic Calming

In terms of urban design, one technique utilized to improve pedestrian safety is to reduce vehicle speeds. While in the U.S. 30 mph is a minimum design speed for arterial and collector roads, in Europe 30 mph is usually a maximum acceptable design speed for roads that have any pedestrian activity. In fact, many residential neighborhoods have even lower speed limits.

The European Commission sponsored the *New Means to Promote Pedestrian Traffic in Cities* (PROMPT) project in order to improve urban mobility (Leden, 2003). The PROMPT team conducted a safety analysis to identify roads that allow safe pedestrian travel. Safe pedestrian travel includes two categories: (1) the ability for pedestrians to cross roads mid-block, rather than just at intersections, in order to reach shops, offices and entrances on either side of the road as well as (2) crossings at special pedestrian crossings. Based on data on the body's tolerance for injury in a crash with vehicles traveling at different speeds, the Swedish Vision Zero program determined that a good quality safety level for both types of pedestrian crossings are roads with vehicles traveling less than 20 mph (30 km/h). The study included spot speed studies, travel surveys with local school children to determine

pedestrian exposure, and analysis of crash data. In addition to lower speeds, additional safety measures identified in the PROMPT analysis included separation of different types of road users, exclusive green for pedestrians at intersections, parking facilities that do not impede visibility of pedestrians, and maintenance of pedestrian facilities.

Universal design is an approach that considers accessibility and usability for the entire population. Dumbaugh (2008) identified the following pedestrian safety strategies based on a universal design for urban areas: complement an arterial system with a network of lower speed two lane roads to allow more local connectivity; enhance connectivity of local street networks, but ensure that vehicle speeds and volumes remain low; balance effective system capacity with increased protected left turns and safe pedestrian crossings; and encourage the establishment of services, including stores and public buildings, on the local lower speed roads.

In the Netherlands and Germany, a number of policies have been put in place to improve the transportation infrastructure used by pedestrians (Pucher & Dijkstra, 2000). Pedestrian zones are very common in these countries and often encompass much of the city center, providing a large area where pedestrians have the right-of-way. Traffic calming in residential areas is central to Dutch and German policies. Traffic calming strategies include reducing speeds in residential areas to 20 mph (30 km/h) or less as well as the installation of physical barriers such as raised intersections, roundabouts, road narrowing, zigzag routes, speed bumps and the like. Traffic calming measures in Europe are generally tailored for an entire area as opposed to a single street, thereby moving traffic out of local residential areas into arterial roadways.

One of the better known area-wide traffic calming strategies in the Netherlands is the *woonerf* or living street. In the *woonerf*, the roadway is shared by pedestrians and vehicles. Vehicles are required to travel at pedestrian speeds and to yield to children at play, pedestrians and bicyclists using the road. Area-wide traffic calming in Dutch neighborhoods has reduced traffic crashes by 20% to 70% (Pucher & Dijkstra, 2000). The range is a result of findings from a wide variety of studies conducted in specific neighborhoods. The results may differ across studies, but positive effects are usually detected. A comprehensive review of traffic calming at the neighborhood level in Germany, Denmark, Great Britain, and the Netherlands found that traffic injuries fell by an average of 53% in traffic calmed neighborhoods (Preston, 1995).

A field study was conducted on roadways in Sweden, focusing on reconstruction of crossings, to determine the elements that improve safety for children and older adult pedestrians at locations where low travel speeds are already in place (Leden, Garder & Johansson, 2006). Reconstruction at the sites included the use of raised paving stones, relocation of crosswalks, marked crosswalks, vehicle lane narrowing, addition of a refuge

island, and the addition of speed cushions.⁴ Video data was captured and coded for each site to analyze road user behavior and vehicle speed data was collected using radar and laser gun. Marked crosswalks were found to improve mobility for pedestrians, in particular resulting in increased yield by drivers. The location of speed cushions at a distance of approximately two car lengths from the crossing reduced speeds and increased yielding to pedestrians. Finally, a meta-analysis of previous research on similar road crossings pointed to increased safety due to improvements to visibility, orientation and clarity at crosswalks (Leden, Garder & Johansson, 2006).

An analysis of all police-reported crashes in North Carolina and fatal crashes in FARS for a 10-year period (1980-1990) was conducted to better understand the causes and characteristics of older pedestrian crashes (Zegeer et al., 1993). Results showed that older pedestrians, age 65 and above, are overrepresented in crashes in urban areas, during daylight hours and in the winter. There is a high incidence of older pedestrian crashes at intersections, in particular involving turning vehicles. Older adults are also overrepresented in crashes involving wide street crossings. The analysis pointed to specific roadway improvements that improve safety for older pedestrians. These include regulations requiring vehicles to park a minimal distance from the intersection, which may provide for a wider field of vision, as well as the removal of street furniture and other obstructions from the walking path. Addition of signs to reduce turning vehicles, such as no turn on red, may reduce the incidence of crashes at intersections. Refuge islands may be particularly helpful for pedestrians walking at slower speeds as they help reduce crossing distances and simplify the crossing task. The addition of traffic signals to create artificial gaps in the traffic flow afford older adults more time to cross. Adequate street lighting also helps to reduce traffic crashes. Finally, establishing pedestrian malls and vehicle-free zones in downtown areas increases pedestrian safety in urban areas.

The Organization for Economic Cooperation and Development (OECD) provided specific design recommendations to ensure safety of pedestrians, in particular those with limited mobility or handicaps (2000). The guidelines include the following recommendations:

- A minimum obstacle free footway at least 1800 mm wide – preferably 2000-2500 mm;
- Widths of sidewalk pavement should be greater at bus stops (minimum 3000 mm) and in front of shops (3500 mm or more);
- Where there is a drop or steep slope at the rear side of a footpath (or both sides of a footpath) the curb should end with a 100 mm raised edge as a safeguard for wheelchair users and as a tapping rail for long cane users;

⁴ Speed cushions are a traffic calming device positioned along the width of the roadway. Speed cushions are narrow in width to allow emergency vehicles and buses to partially straddle the device. Speed cushions are raised about 3 inches in height and are approximately 10 ft. in length.

- Surfaces should be non-slip, well-maintained and any joints between paving slabs should be closed and flush to avoid catching the small wheels of a wheelchair;
- Covers and gratings should be non-slip and flush with the pavement surface;
- Nothing should overhang the footway (signs, tree branches, etc.) to a height of less than 2100 mm (preferably 2500 mm);
- Where it is not possible to avoid having obstacles in the pavement, such as lamp posts, traffic signs, etc. the pavement should include a contrasting band of color 140 mm to 160 mm wide with the lower edge 1.5 to 1.7 meters above ground level. Trees in the footway should have a distinctive surface around them (for example grating or pebbled) to warn blind pedestrians;
- Seating should be provided at regular intervals of around 100 meters;
- Busy junctions should have a type of control to assist pedestrians across the road, such as zebra crossings or signalized crossing;
- Crossings should have dropped curbs and tactile warning surfaces;
- Audible or tactile signals should be installed at controlled crossings for visually-impaired pedestrians;
- Traffic free areas that are designed for pedestrians should be non-slip and well-lit with minimum encroachment of street furniture on the walking areas;
- Signs ought to be posted at eye height. In cases where the sign has to be raised the height should still be feasible for smaller adults to read; and
- In order to ensure that dynamic signs are readable, at least 10 seconds should be allowed for reading or preferably longer.

A study in Denmark investigated preferences and behaviors of older adult pedestrians (70 and above). Comfort while walking was enhanced by the presence of signalized intersections, pedestrian crossings, paved walkways, long green cycles for crossing, and low curbs (Bernhoft & Cartensen, 2008).

Many of the above countermeasures have been recommended by NHTSA and the Institute of Transportation Engineers (2004). Engineering measures have an associated cost; therefore it is important to select those techniques that have been correlated with reduced pedestrian injuries.

In a study to develop pedestrian safety zones for older adults in Phoenix, engineering countermeasures included posting of signs at intersections explaining the pedestrian signal phases, adjustments to signal timing, removal of impediments to sight distance, pavement repairs, and repainting crosswalks (Levy et al., 1998). The study also included an educational component, PSAs and a variety of printed materials. An analysis of Phoenix pedestrian crash data showed that older adult crashes decreased and this decrease was

greatest in the safety zones. The largest decrease in crashes occurred at intersections that underwent engineering improvements. Residents reported in a survey that they were aware of the countermeasure program.

The *Walk Wise, Drive Smart* program was conducted to improve pedestrian safety and walkability for older adults in Hendersonville, North Carolina, under a NHTSA-funded cooperative agreement (Hunter & Hunter, 2008). Ten neighborhoods having a high proportion of older adults were identified, and residents in those neighborhoods who participated in focus groups and interviews described popular walking routes and the walking conditions. The *Walk Wise, Drive Smart* program utilized the Environmental Audit Tool developed by the CDC Healthy Aging Research Network to conduct audits while walking. This tool focuses on land use, destinations, walkways, street characteristics, the aesthetic and social environment, and intersection traffic and facilities. Finally, the Environmental Audit Tool was followed up by photo audits of routes conducted by the *Walk Wise Drive Smart* program staff. Needed changes were identified for each of the routes, and were made one route at a time. Improvements in the 10 neighborhoods included new sidewalk sections, repaving crosswalks, repainting crosswalks, filling in holes or pits, filling in edge drop-offs, pedestrian mid-block crossing signs, and rerouting of traffic.

Engineering countermeasures that increase walkability for older adults as well as all pedestrians have an added benefit as these measures often result in increased pedestrian traffic (Staunton, Frumpkin & Dannenberg, 2008). Researchers have pointed to safety in numbers, with reduced motor vehicle-related crashes in areas with high visibility pedestrian and bicycle traffic (Elvik, 2009; Jacobsen, 2003; Leden, 2002). Essentially the more pedestrians there are, the lower the risk faced for each pedestrian.

9. Conclusions

Pedestrians and drivers share responsibility for many pedestrian fatalities, as pedestrians and vehicles attempt to navigate through the same space at the same time. Because no single pedestrian fatality cause stands out, no single countermeasure alone would likely make a substantial impact on the number of older pedestrian crashes. A successful countermeasure program may need to use a mix of environmental, educational, and enforcement measures to improve pedestrian safety. In consulting with experts and examining existing literature and programs, a number of key components and recommendations for future programs and campaigns have been identified. In particular, a number of successful health promotion and pedestrian safety campaigns were comprised of multiple components including media, community-based interventions, engineering countermeasures, and program evaluation. Each of these elements is important in promoting older adult pedestrian safety among individuals and in the community as a whole. In designing media campaigns, formative research is a key ingredient. Consultation with the target population via focus groups or other interactive means is the basis for formulating an effective message. A number of health communication media campaigns were developed

using a theoretical model such as the Theory of Planned Behavior (TPB), or the Transtheoretical model. These campaigns all involve contributions and/or “buy in” from the target population, stakeholders and advocates for the target group during the developmental stages of the campaign or program. Many of the programs in this report engaged older adults in the development stages, providing them ample opportunity to be heard (Smerz; 2003; Downing & Jones, 2008; Reger et al., 2002).

Additionally, developing the media campaign using appropriate content, structure, exposure, types of appeal, and channels of communication for older adults is essential. Based on the literature, the message of health communication campaigns, in particular for older adults, needs to specifically address the needs of the targeted older adult population. The message should be simple and direct, include answers to relevant questions, as well as address specific issues and concerns that they have as a group. Many older adults ignore the messages of national campaigns, believing that they are intended for a younger audience (Levi & De Leonardis, 2008).

There is no standard method for delivering the message. Some health campaigns used brochures that focused on issues and questions which concerned older adults, and used photos of older adults to complement the information presented in the brochure (Downing & Jones, 2008; Reger et al., 1998; NFPA, n.d.). Older adults have said that this was an effective strategy given that many older adults rely on medical brochures and reading material for health-related information. When developing handouts, brochures, and/or display cards one should consider the visual and cognitive declines experienced by older adults. The design of the handouts should be simple. The font should be slightly larger than standard and increase contrast. The paper material selected should have a low glossiness to reduce glare.

Other campaigns utilized paid advertising via newspapers, television, and radio to communicate a single message (Reger et al., 1998; Reger et al., 2002). These techniques may have also been used in combination with community-based activities such as press conferences, educational programs and presentations by local health professionals at community centers. Many older adults respond well to community outreach programs that allow professionals to personally interact with the older adults in locations where they reside or socialize (NFPA, n.d.).

Messages that are presented in a clear and appealing manner are more likely to effect a change in behavior. Successful campaigns have used a variety of strategies to provide useful information and guidance to older adults. Some programs have identified the potential risks of their behavior, or the effects and consequences of their behavior to themselves and to those around them (e.g., grandchildren). Other programs provide answers to their questions or concerns in a very simple and direct manner (Downing & Jones, 2008; Levi & De Leonardis, 2008; Tait et al., 2006). To illustrate, a study to identify best methods to promote organ donor registration among older adults found that older adults support the idea of organ donation. However, their belief that their health or age makes them ineligible is a major barrier to registration. These perceptions were often related

to a lack of knowledge regarding the organ donation process. Based on these results, the type of appeal developed was one that provided adequate information about organ donation including information on the potential barriers to organ donation (Downing & Jones, 2008).

Older adults have said in focus groups that real-life images and stories of people are effective in promoting a change in behavior (Levi & De Leonardis, 2008). Images and stories that are realistic and empathetic, while conveying a simple and clear message, are often seen as more credible, and credibility has been found to be an important basis for the design of media messages to induce safety and health behavior.

There are a variety of channels of communication that may be used in a health promotion campaign for older adults including printed media, television and radio, and the Internet. Health communication programs may be community-based, utilize education and training, or employ local professionals, stakeholders or advocates. There is no single correct answer as to which mode is most suitable. Some older adults indicate that printed material is the preferred channel, while others point to television, community programming, physicians, and even the internet. Each of these modes is unique and should be tailored to the target population.

Printed materials should be designed in an appropriate manner for older adults in both content and structure. Television communication, while popular, should also be tailored based on the topic and audience in order to compete with the intense media environment. Internet communication has the potential to allow for more personal messaging; however, older adults do not use it as often as do younger adults. Programs in community venues, local task forces, walking groups, peer to peer training, and lectures by representatives of the health and safety professional network are yet another means to provide information on pedestrian safety.

Engineering countermeasures have the potential to improve safety and walkability for older adults, as well as for all pedestrians in the community. Among the most effective solutions reported in the literature are interventions whose main goal is to separate vehicular traffic from pedestrians. This can be accomplished by separating the pedestrians from the vehicles either by space or time. Other engineering designs are directed towards increasing the conspicuity of pedestrians or reducing the speed of vehicles. Common engineering countermeasures include roundabouts and lane narrowing and improvements to intersections such as extended traffic signals for pedestrian crossings, the addition of refuge islands, and increased lighting at pedestrian crossings. Many of the successful pedestrian safety programs incorporated audits or evaluation of walkability of roads in neighborhoods with a high percentage of older adult residents. A review of local infrastructure issues allows for prioritizing engineering countermeasures and long-term planning. In a series of focus groups on transportation issues conducted with older adults in three States, the top priorities identified to increase pedestrian safety were visible sidewalks, safer intersections, and more time to cross at the walk cycle (Kerschner & Aizenberg, 2004).

Based on information gathered on effective health communication and pedestrian safety programs in the United States and globally, it is possible to design an effective strategy to target pedestrian safety among older adults. A multi-mode program that incorporates elements of effective health communication programming and engineering countermeasures will increase the likelihood of success.

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